

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
TOTAL	



General Certificate of Education
Advanced Level Examination
June 2010

Physics

(Specifications A and B)

PHA6/B6/X

Unit 6 Investigative and Practical Skills in A2 Physics
Route X Externally Marked Practical Assignment (EMPA)

Section A Task 1

For this paper you must have:

- a calculator
- a pencil
- a ruler.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Show all your working.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for Section A Task 1 is 15.



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PHA6/B6/X

Section A Task 1

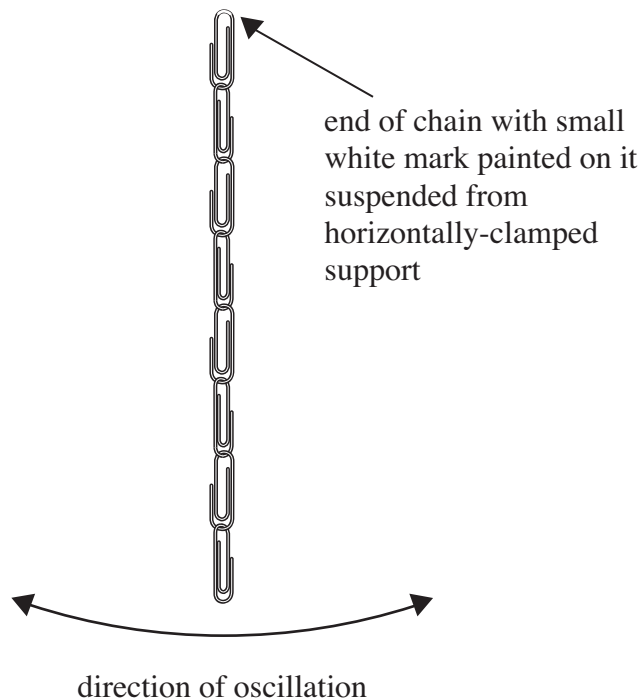
Follow the instructions given below.

Answer **all** the questions in the spaces provided.

No description of the experiment is required.

- 1** You are to investigate the small-amplitude oscillations of a chain, suspended from one end, in a vertical plane.
- 1 (a)** You are provided with three short chains, each consisting of eight paper clips joined together. One end of each chain has a small white mark painted on it to show the end from which it should be suspended. Suspend one chain from the horizontally-clamped support so that the chain hangs freely in a vertical plane. The white mark should be at the point of suspension of this chain. Displace the lower end then release the chain so that it performs small-amplitude oscillations in a vertical plane, as shown in **Figure 1**.

Figure 1



- 1 (a) (i)** Make and record suitable measurements to calculate the period, T_1 , of the oscillations of this chain. You should use a fiducial mark to assist in making these measurements.

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$$T_1 = \text{.....}$$

- 1 (a) (ii)** Connect one of the other chains to the lower end of the suspended chain, thereby doubling the number of inter-connected paper clips. The white mark on the lower chain should be at the point of suspension to the upper chain. Repeating the procedure as before, make and record suitable measurements to calculate the period, T_2 , of the oscillations of this chain.

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$$T_2 = \text{.....}$$

- 1 (a) (iii)** Connect the remaining chain to the lower end of the suspended chain, thereby suspending all the paper clips in a single chain. The white mark on the lower chain should be at the point of suspension to the upper chain. Repeating the procedure as before, make and record suitable measurements to calculate the period, T_3 , of the oscillations of this chain.

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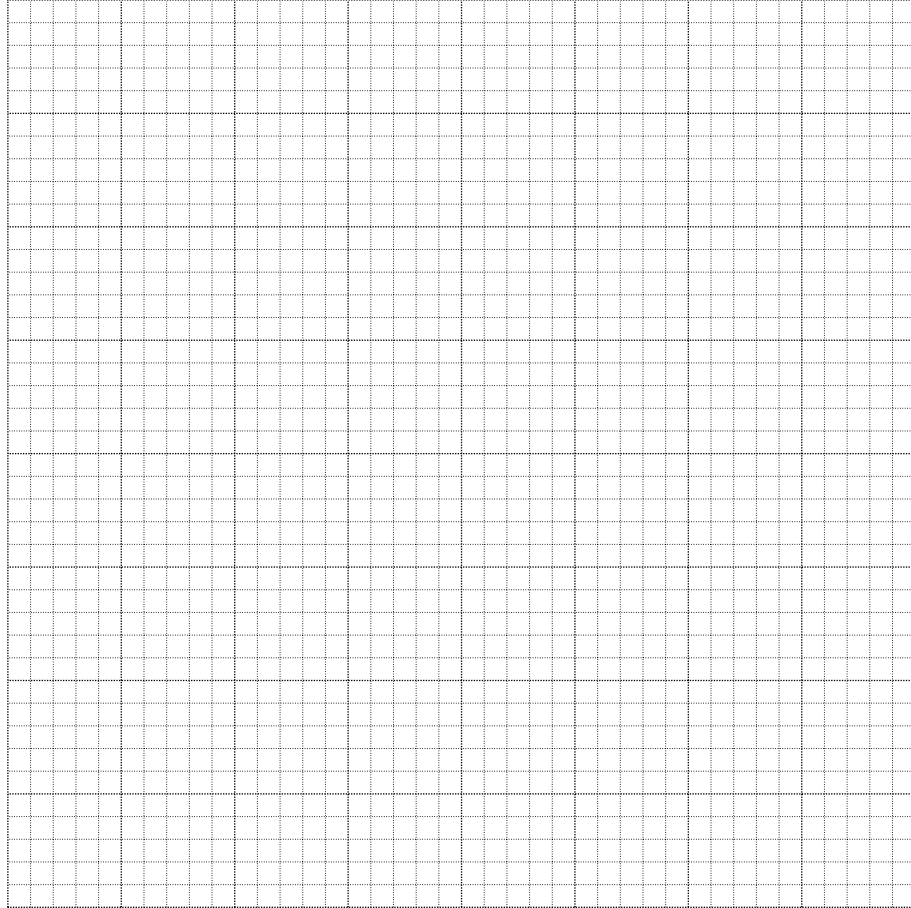
$$T_3 = \text{.....}$$

(3 marks)

Question 1 continues on the next page

Turn over ►

- 1 (b) It is suggested that n , the number of suspended paper clips is related to T , the period of the paper clip chain by an expression of the form $n \propto T^x$ where x is an integer. With the aid of the grid provided or otherwise, use the results that you obtained in part (a) to determine the value of x .



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$x =$

(4 marks)

1 (c) A student claims that T can be calculated in the same manner as the period of a simple pendulum of length equal to that of the chain.
Show that the student's claim is false.

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(2 marks)

9

Turn over for the next question

2 You are provided with two identical pendulums coupled to each other by thread from which four paper clips have been suspended.

2 (a) Displace the bob of the left-hand pendulum about 5 cm leftwards, keeping the string in the vertical plane defined by the rest position of the pendulums. Release the bob and observe the subsequent motion of both pendulums; you will see that the amplitude of the left-hand pendulum gradually decreases and the amplitude of the right-hand pendulum increases. After a certain time has elapsed, the left-hand pendulum briefly comes to rest and the right-hand pendulum swings with maximum amplitude, then the transfer of energy between the pendulums reverses until the right-hand pendulum is once again at rest and the left-hand pendulum swings with maximum amplitude.

Make suitable measurements to calculate the time, τ , for the amplitude of either pendulum to increase from zero to a maximum and then fall to zero again. Labels, on which you may write, have been placed on the edge of the bench to assist you in making these measurements.

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$\tau =$

(1 mark)

2 (b) It is suggested that τ may be inversely proportional to the number of paper clips suspended from the thread.

2 (b) (i) Make measurements to calculate τ with five paper clips suspended from the thread.

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$\tau =$

2 (b) (ii) Make additional measurements to calculate τ with six paper clips suspended from the thread.

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$\tau =$

2 (b) (iii) Explain whether your results from parts (a) and (b) show that τ is inversely proportional to the number of paper clips suspended from the thread.

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(4 marks)

2 (c) Explain **one** difficulty that might be encountered if you were to make measurements to determine τ with **less than** four paper clips suspended from the thread.

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(1 mark)

6

END OF QUESTIONS

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED**